

# **TECHNICAL/REQUIREMENTS**

## **DIVISION IV - WATER**

### **IV.1 TRENCH EXCAVATION, PIPE ZONE, AND BACK FILL**

#### **IV.1.A.00 DESCRIPTION/SCOPE**

Trench excavation, pipe zone, and back fill shall conform to the requirements as stated in Section III.1, TRENCH EXCAVATION, PIPE ZONE, AND BACKFILL, except as follows:

##### **IV.1.A.01 PIPE BEDDING**

Pipe bedding and pipe zone material shall be required for service installations in conformance with the applicable requirements of III.I, TRENCH EXCAVATION, PIPE ZONE, AND BACK FILL.

##### **IV.1.A.02 NATIVE MATERIAL**

Mechanical compaction of native material will be required in conformance with Section III.1.D.07.2.a CLASS A BACKFILL, unless otherwise specified in the Special Provisions.

### **IV.2 PIPE INSTALLATION**

#### **IV.2.A.00 DESCRIPTION/SCOPE**

This section covers the pipes, fittings, services, and appurtenant materials normally used for water distribution systems and the care in transporting, handling, and storage of such materials in addition to the sanitation, installation, flushing, and disinfection requirements for the construction of waterlines.

Unless specified herein, pipe installation shall be performed in strict conformance with the manufacturer's recommendations.

#### **IV.2.B.00 DEFINITIONS**

##### **IV.2.B.01 DISTRIBUTION MAIN**

A water distribution main is described as that part of the water system providing flow to domestic services, irrigation services, fire services, and fire hydrants.

##### **IV.2.B.02 SERVICE**

A service is described as a section of the water system that provides only 1 point of exit from the distribution system. Examples are; domestic meter, irrigation meter, fire service

(double detector backflow assembly, metered reduced pressure backflow assembly), fire hydrant, and combination air-vacuum valve.

#### **IV.2C.00 MATERIALS**

##### **IV.2.C.01 GENERAL**

Only materials designed for potable water service and meeting the current National Sanitation Foundation Standard (NSF) 61, Section 9, Drinking Water System Components - Health Effects, or equivalent shall be used in those elements of the water system which are in contact with potable water.

Materials shall be furnished by the Contractor. The Contractor's responsibility for material shall begin at the point of delivery thereof to said Contractor or on the day of the award of the Contract for materials existing on the construction site prior to that time. The Contractor shall examine all material at the time and place of delivery and shall reject all defective material. Materials shall conform to all specified requirements. Records of specific tests and/or affidavits of compliance shall be supplied for appropriate materials upon request.

Materials delivered to the site which do not meet the approval of the Engineer or which become unsuitable or unacceptable for use after approval shall be rejected by the Engineer and shall not be used. No materials shall exist on the construction site which are not suitable for installation. Materials which are rejected due to defects in manufacture or which become damaged or otherwise unsuitable for use after acceptance, regardless of cause, shall be promptly removed from the site by the Contractor. Materials found to be defective in manufacture prior to final acceptance of the work and installed without discovery of such prior defects shall be replaced with sound material by the Contractor. Materials damaged during construction or found to be defective during the 1 year warranty period following final acceptance shall be replaced with sound material by the Contractor. In either case, the Contractor shall furnish all incidentals, labor, and equipment necessary to replace any defective materials to the satisfaction of the Engineer all at the expense of the Contractor.

Where specific brand names and/or models of materials are mentioned on the Plans or in the Specifications, it shall be understood that such materials are of the required and acceptable quality. Other materials may be substituted only if the Contractor provides the Engineer with appropriate and sufficient technical information regarding the proposed substitution and the Engineer subsequently determines that the materials are of acceptable quality and approves the substitution prior to bidding. Miscellaneous materials and appurtenances not specifically mentioned on the Plans or in the Specifications shall be new and of equal or better quality than other specified materials that their usage is dependent upon; and, in the event such a comparison cannot be made then only materials approved by the Engineer shall be furnished.

## IV.2.C.02 WATERLINE PIPE

### IV.2.C.02.1 DUCTILE IRON PIPE

Unless otherwise specified, all pipe for water mains shall be cement-lined ductile iron pipe in conformance with AWWA C151 (ANSI A21.51) with joint ends as specified on the Plans. Cement-mortar lining shall be in conformance with AWWA C104 (ANSI A21.4). The minimum thickness class shall be Class 52. Under extreme conditions, such as in deep trenches and/or corrosive soils, higher thickness classes may be required as indicated on the Plans. All ductile iron pipe will be tube-form polyethylene encased in conformance with AWWA C105 (ANSI A21.5) for installation below the water table. Materials and installation for electrical continuity or bond bars, as may be necessary in corrosive soils, shall be as described in the Special Provisions. Acceptable ductile iron pipe:

American  
U.S. Pipe  
Pacific States  
Griffin Ductile Iron Pipe

### IV.2C.02.2 COPPER WATER TUBE

Seamless copper tubing shall be of domestic manufacture and supplied in conformance with ASTM B-88, Type K, soft.

### IV.2.C.02.3 RED BRASS PIPE

Seamless red brass pipe shall be of domestic manufacture and supplied in conformance with ASTM B-43.

## IV.2.C.03 WATERLINE FITTINGS

### IV.2.C.03.1 DUCTILE IRON FITTINGS

All tees, crosses, elbows, reducers, combinations thereof, and other miscellaneous iron fittings shall be cement lined or ductile iron in conformance with AWWA C110 or C153 (ANSI A21.10). Cement lining shall be in conformance with AWWA C104 (ANSI A21.4). Joint ends shall be as specified on the Plans.

Unless otherwise noted on the Plans, all fittings shall have minimum pressure ratings of 150 psi. Acceptable ductile iron fittings:

American  
Tyler  
U.S. Pipe

#### IV.2.C.03.2 CAST BRONZE FITTINGS

Cast bronze fittings for making screwed joint connections shall conform to ANSI B16.15. Fittings for making connections with flared copper tubing shall conform to ANSI B16.26.

#### IV.2.C.03.3 (Deleted)

#### IV.2.C.03.4 BRASS/BRONZE FITTINGS

All brass/bronze fittings shall be of domestic manufacture.

##### IV.2.C.03.4.a CORPORATION STOPS

Corporation stops for services, air valves, chlorinating, and retesting shall be supplied in conformance with AWWA C800-66. Acceptable corporation stops:

Services	1-, 1 ½- and 2-Inch Ball Corps
Jones J-1500	Jones J-1930
Mueller H-15000	Mueller B-2500
Ford F-600	Ford FB-600
Approved Equal	McDonald 4701B Approved Equal

##### IV.2.C.03.4.b ANGLE METER VALVES

Angle meter valves shall be supplied in conformance with ASTM B62. All angle meter valves shall have a lock wing. Acceptable angle meter valves:

1-inch Meter  
Ford BA23-444W  
Jones J-1964W  
Mueller B-24255-3  
McDonald 4602B

#### IV.2.C.04 MECHANICAL COUPLINGS

Mechanical couplings shall consist of ductile iron MJ sleeves of the same manufacture as the pipe or fitting.

#### IV.2.C.05 PIPE JOINTS

##### IV.2.C.05.1 FLANGED JOINT

Flanged joints for ductile iron pipe shall be in conformance with AWWA C115 (ANSI A21.15). Gaskets shall be 1/8-inch thick rubber, either drop in ring or full face, conforming to the pipe manufacturer's requirements. Bolts and nuts shall be zinc plated or stainless steel.

##### IV.2.C.05.2 MECHANICAL JOINTS

All components of mechanical joints shall be in conformance with AWWA C111 (ANSI A21.11). All mechanical joints shall utilize approved retainer glands. Mechanical joint T-bolts will be ductile iron.

##### IV.2.C.05.3 PUSH-ON JOINTS

Single rubber gasket push-on joints shall conform to AWWA C111 (ANSI A21.11). Unless otherwise specified, gaskets and lubricant shall be provided by the manufacturer of the pipe fitting on which they are to be used.

#### IV.2.C.06 VALVES AND ACCESSORIES

##### IV.2.C.06.1 GATE VALVES

###### IV.2.C.06.1.a BRONZE-BODY GATE VALVES

Bronze gate valves shall be used for all valves smaller than 2-inches and shall be domestic Class 125 nonrising stem solid disc type with screwed or union bonnet, threaded ends, and brass handle. Body, bonnet, operating handle, and disc shall be ASTM B-62 bronze. Stems shall be copper silicon alloy, nickel plated steel, or other approved corrosion resistant materials with equal characteristics of strength and durability. The disc shall clear the port area completely in the fully opened position. Threaded ends shall conform to ANSI B2.1. Acceptable bronze gate valves:

Stockham B-103 or B-115  
James Jones Model 372  
Ohio Brass No. 2500  
Jenkins Figure 370  
Nibco T-113

###### IV.2.C.06.1.b DUCTILE IRON GATE VALVES

All valves 2- to 8-inches in size shall be resilient-seated epoxy coated ductile iron gate valves and shall meet or exceed the provisions of AWWA C509 and shall be a nonmetallic seat, nonrising stem type with O-ring seals and a 2-inch square operating nut which opens the valve when turned counterclockwise. With the valve fully open, an unobstructed

waterway not less than the full nominal diameter of the valve shall be provided. Valves shall have joint ends as specified on the Plans. Acceptable gate valves:

Kennedy "Ken-Seal"  
Clow "Resilient Wedge"  
Mueller  
Pratt

#### IV.2.C.06.2 BUTTERFLY VALVES

All valves larger than 8-inches shall be rubber seated butterfly valves and shall meet or exceed the provisions of AWWA C504 Class 150B. Butterfly valves shall be short bodied cast iron construction with joint ends as specified on the Plans. All valves shall be of the tight closing type with two way thrust bearing and shall be equipped with a 2-inch square operating nut which opens the valve when turned counterclockwise. Acceptable butterfly valves:

American Darling  
Dresser "450"  
Pratt "Ground Hog"  
Kennedy  
Clow  
Mueller "Linesal III"

#### IV.2.C.06.3 TAPPING / LINE STOP SLEEVES

Tapping and line stop sleeves shall be full circle stainless steel construction with a full circle rubber gasket and a flanged outlet for bolting to the tapping / line stop valve. Sealing may be accomplished by either split end gaskets and mechanical joint ends or a single rubber gasket around the tap opening. Bolts and nuts shall be zinc plated or stainless steel. Acceptable tapping sleeves:

Ford Fast  
Smith Blair  
Romac SST

Acceptable line stop sleeves:

Smith Blair 680 Series

#### IV.2.C.06.4 VALVE OPERATOR EXTENSIONS

Valve operator extensions shall consist of 1-inch bar stock with a valve wrench cup attached to 1 end and a 2-inch square operating nut to the other. The valve wrench cup and operating nut shall be attached to the ends in such a manner as to withstand without damage an input torque of 300 foot-pounds.

#### IV.2.C.06.5 ADJUSTABLE VALVE BOXES

Valve boxes shall be constructed of cast iron and shall be a slip-type. The valve box cover shall be a Cast Iron "Pick Hole" type cover with the word "WATER" cast into it and of domestic manufacture. Acceptable adjustable valve boxes:

Rich "Medford" 931  
Tyler/Union 7016-7026

#### IV.2.C.06.6 AIR VALVES

Air valves shall be combination air release type which permit entrained air to escape from the line while retaining water upon filling and which permit a reverse flow of air into the line upon draining. The valve body, cover, and lever frame shall be cast iron or approved alloy. The float shall be stainless steel and shall close against a rubber valve seat. All other internal parts shall be either stainless steel or bronze or other approved non corrodible material. Air valves shall be installed in an approved enclosure. Acceptable combination air release valves:

APCO 143C or 145C

Acceptable air release valve enclosures:

Hot Box Vent Guard

#### IV.2.C.06.7 BALL VALVES

Ball valves shall be of brass construction with a stainless steel ball.

Acceptable ball valve:

Appllo 70-103-10  
Watts B 6000  
Ohio Brass 100-B

#### IV.2.C.06.8 SAMPLING STATIONS

Sampling stations shall be above ground units with a secured aluminum enclosure, all brass waterway, non-threaded nozzle, and protection from freezing without the use of drain holes. Sampling stations will be designed for removal of all exterior parts for maintenance without excavation of the surrounding soil. Acceptable sampling stations:

Eclipse No. 88

#### IV.2.C.06.9 AUTOMATED FLUSHING STATIONS

Automated flushing stations will be fully enclosed and equipped with a locking mechanism. All units will be programable and battery operated. Flushing stations will be designed to direct discharge to a sanitary sewer. Acceptable automated flushing mechanisms:

Hydro-Guard, Direct Discharge Unit

#### IV.2.C.07 THRUST RESTRAINT

##### IV.2.C.07.01 ANCHORAGE AND REACTION BLOCKING

Concrete for anchorage and reaction blocking shall be a batch mix concrete mix which shall provide a minimum 28 day strength of 3,000 psi.

##### IV.2.C.07.2 JOINT RESTRAINT

Restrained mechanical joint retainer glands shall be of ductile iron construction and compatible with standard mechanical joint bells. Gland, gaskets, tee head bolts, and hex nut shall be in conformance with AWWA C111 (ANSI A21.11). Retainer glands shall have rated working pressures of 350 psi for pipe sizes 6-inch and smaller, 250 psi for pipe sizes 8-inch through 16-inch, 200 psi for 18- and 20-inch pipe sizes, and 150 psi for pipe sizes 24-inch and larger. Acceptable retainer glands:

EBA 100 Series  
Romagrip  
Uni-flange Series 1400

#### IV.2.C.08 FIRE HYDRANTS

Fire hydrants shall be a dry barrel, center stem type in conformance with AWWA C502. Hydrants shall have two 2 1/2-inch hose nozzles with National Standard threading (7 1/2 threads per inch) and a 4 1/2-inch pumper nozzle with National Standard threading (4 threads per inch). The hydrant valve opening shall be 5-inches. Inlet connections shall be 6-inch. Hydrants shall have a 1 1/4-inch pentagonal operating nut which opens the hydrant when turned counter-clockwise. Seals shall be O-ring throughout. Hydrants shall be designed as traffic models with a safety breakaway flange and shall be painted Pittsburgh Paint Safety Orange (No. 90-313). All port cap chains shall be removed. Acceptable fire hydrants:

Clow Medallion  
Mueller Super Centurian  
Kennedy K-81  
M&H Regent 129I

A 5-inch Storz adapter with National Standard Threads shall be installed on the pumper port. The adapter shall be constructed of high strength aluminum alloy, have a teflon coated seat and threads. The adapter shall use a rubber gasket to seal all leakage. The adapter shall have a minimum of two set screws to secure it in place. The adapter shall be provided with an approved aluminum alloy pressure cap attached to the Storz adapter with a plastic coated stainless steel cable to prevent loss or theft. Storz adapters with flaps (to eliminate entry of foreign materials into the hydrant) are not approved. Acceptable adapters:

Storz 125 AWG - 5-inch



#### IV.2.C.08.1 FIRE HYDRANT EXTENSIONS

Extension assemblies for fire hydrants shall be supplied by the manufacturer of the hydrant for which the extension is required.

#### IV.2.C.09 METER BOXES

##### IV.2.C.09.1 CONCRETE METER BOXES

Precast concrete meter boxes shall be constructed of concrete with a minimum compressive strength of 4,000 psi. Covers to be furnished with the boxes shall be solid cast iron or reinforced concrete with a rod-hinged self-closing cast iron reading lid with a cast iron frame as required. Acceptable concrete meter boxes:

3/4-inch angle stops - Christy Model B-12

1-inch angle stops - Christy Model B-30

1 1/2-inch and 2-inch angle stops - Christy Model B-36

#### IV.2.D.00 CONSTRUCTION/WORKMANSHIP

##### IV.2.D.01 PROGRESS OF CONSTRUCTION

It is intended that the progress of the work shall be in a systematic manner so that as little inconvenience as possible will result to the public in the course of construction. It is necessary, therefore, that the Contractor confine operations to as small a length of work per crew as is feasible. The length of trench excavated in advance of the pipe laying shall be kept to a minimum and in no case shall the trench be left open overnight unless otherwise authorized by the Engineer. Complete back fill and cleanup shall progress as each section of pipe has been inspected and approved.

##### IV.2.D.02 TRANSPORTING AND HANDLING OF MATERIALS

Every effort shall be made to ensure that all pipe, fittings, valves, hydrants, and other appurtenances are protected against damage during transporting and that they are loaded and unloaded in such a manner as to avoid shock or damage. Under no circumstances shall such materials be dropped. Minor damage which may occur to materials shall, at the Contractor's option and the Engineer's approval, be repaired by the Contractor in a manner satisfactory to the Engineer. Any material that the Contractor elects not to repair or that in the judgment of the Engineer is damaged beyond repair shall be removed from the job site. No payment will be made for any damaged material removed from the job site nor for any cost incurred in the repair or removal of any damaged materials.

##### IV.2.D.03 STORAGE OF MATERIALS

The Contractor shall be responsible for the safe storage of material furnished by or to him/her, accepted by him/her, and intended for use in the construction until it has been incorporated in the completed project.

Materials shall be stored to assure preservation of their quality and fitness for the work. Pipe, fittings, valves, and hydrants shall be drained and stored in such a manner as to prevent water from collecting and ponding in them so as to protect them from damage by freezing and shall be kept free from dirt and other foreign matter at all times. Pipe ends should be sealed when in storage. Stored materials, even though approved before storage, may again be inspected prior to their use in the work and shall be located so as to facilitate their prompt reinspection.

Portions of the right-of-way approved by the Engineer may be used for storage purposes. Any additional space required shall be provided by the Contractor at his/her own expense. Private property shall not be used for storage purposes without written permission of the property owner. Copies of such written permission shall be furnished to the Engineer.

#### IV.2.D.04 DISTRIBUTION OF MATERIALS

Materials shall be distributed along the proposed waterline route no faster than can be installed in 1 day's work unless otherwise authorized by the Engineer. Materials distributed and not installed within a reasonable amount of time as determined by the Engineer shall be collected and properly stored by the Contractor at no extra cost until he/she is ready to proceed with the work.

Materials shall be distributed in such manner as not to be damaged in the process and shall under no circumstances be dragged along the ground. Due consideration shall be given to the occupants of adjoining property, pedestrians, and vehicular traffic to assure no hazard will be presented.

#### IV.2.D.05 PLACING OF MATERIALS IN THE TRENCH

All pipe, fittings, and hydrants shall be lowered into the trench in such a manner as to prevent damage. Prior to lowering materials into the trench, the Contractor shall check for damage and shall either repair or reject any damaged materials. All repair work shall be completed to the satisfaction of the Engineer prior to placing the material in the trench.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If it is not possible to place the pipe in the trench and into position without getting earth into it, the Engineer may require that a suitable plug be placed in each end of the pipe before lowering it into the trench and left in place until the connection is to be made to the adjacent pipe. Debris, tools, rags, and other materials shall be kept out of the pipes at all times.

Pipe shall be laid and joined one length at a time to the required line and grade. Pipe shall be placed with the bell end facing the direction of laying except for lines on a grade in excess of 15% in which case bells shall, at the direction of the Engineer, face upgrade. No pipe shall be laid when standing water exists in the trench or when trench conditions are otherwise unsuitable in the opinion of the Engineer.

#### IV.2.D.06 SANITARY PRACTICES DURING INSTALLATION

All lumps, blisters, and excess coal tar coating shall be removed from the bell and spigot end of each pipe prior to installation. The outside of the spigot and the inside of the pipe shall

be clean and dry and free from all foreign matter before the pipe is laid. If, in the opinion of the Engineer, the pipe contains dirt or other foreign matter that will not be removed during the flushing operation, the interior of the pipe shall be swabbed with chlorine or otherwise cleaned as necessary to remove the contaminants.

Whenever the trench site is left unattended, the open ends of the pipe shall be sealed with a water tight plug to prevent trench water, animals, and foreign matter from entering the pipe. This shall apply during the noon hour as well as overnight. If any water is in the trench, the seal shall remain in place as long as the water would otherwise be able to enter the pipe.

#### IV.2.D.07 CUTTING

The cutting of pipe for inserting valves, fittings or closure pieces shall be done in such a manner as to prevent damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. The cut end of the pipe shall be ground smooth and for push-on joint connections shall be beveled in order to remove sharp edges which may damage the gasket. Any lining or coating damaged in the cutting process shall be repaired by the Contractor to the satisfaction of the Engineer.

#### IV.2.D.08 ALLOWABLE DEFLECTION AT JOINTS

When push-on or mechanical joint pipe is to be laid on a curve, either in the horizontal or vertical plane, the amount of deflection shall not exceed the maximum limits given in Table I below for each type of pipe joint or those recommended by the manufacturer, which ever is less. Where pipe lines are intended to be laid in a straight line, the deviation from the Plans for each section of pipe shall not be in excess of 0.2-foot for line and 0.1-foot for grade.

TABLE I MAXIMUM DEFLECTION 18-FOOT PIPE LENGTH				
<u>PIPE DIAMETER</u>	PUSH-ON JOINT		MECHANICAL JOINT	
	DEFLECTION ANGLE (degree)	DEFLECTION (inch)	DEFLECTION ANGLE (degree)	DEFLECTION (inch)
3	5	19	8	31
4	5	19	8	31
6	5	19	7	27
8	5	19	5	20
10	5	19	5	20
12	5	19	5	20
14	3	11	3 ½	13 ½
16	3	11	3 ½	13 ½
18	3	11	3	11
20	3	11	3	11
24	3	11	2 ½	9
30	2	7 ½	2 ½	9
36	2	7 ½	2	8
42	2	7 ½	2	7 ½
48	2	7 ½	2	7 ½

#### IV.2.D.09 PIPE SEALANT

When utilized, pipe sealant shall be placed on threads only. Sealant shall be applied as a thin film. No sealant is allowed inside the face of a flared fitting.

#### IV.2.D.10 JOINTING

All jointing procedures shall be in strict compliance with the manufacturer's recommendations and as approved by the Engineer. The Contractor shall provide any special tools and equipment necessary for the installation. The following are given as general guidelines for each type of joint:

##### IV.2.D.10.1 FLANGED JOINTS

Contact faces and gaskets for flanged connections shall be free of all foreign matter before the connection is made. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then completed by tightening the bolts uniformly. Cast flanges and flanged fittings shall be properly anchored, supported, or restrained after installation to prevent breakage and care shall be taken to prevent bending or torsional strains from being applied during the jointing procedure.

##### IV.2.D.10.2 MECHANICAL JOINTS

After ensuring that all joining surfaces are free from foreign matter, the pipe shall be inserted in the socket and the gasket pressed firmly and evenly into the gasket recess while keeping the joint straight. Bolts shall be tightened so that the gland is brought up evenly toward the pipe flange with the spigot and centrally located in the bell. The normal range of bolt torques for various sizes of bolts shall be given below. The procedure shall be repeated if effective sealing is not attained at the maximum torque. Overstressing of bolts to compensate for ineffective sealing or poor installation practice shall be unacceptable. Any required deflection of joints shall be made after the joint is assembled but before final tightening of the bolts.

<u>Bolt Diameter</u> <u>(inches)</u>	<u>Torque Range</u> <u>(foot-pound)</u>
5/8	45 - 60
3/4	75 - 90
1	100 - 120
1-1/4	120 - 150

##### IV.2.D.10.3 PUSH-ON JOINT

The plain end of the pipe for push-on joint connections shall be beveled before proceeding with the jointing operation. The plain end shall then be lubricated after dirt and foreign material has been removed from all jointing surfaces and the gasket has been installed in the bell end. The joint shall be kept straight while pushing the plain end into the bell of the pipe with any required deflection being made after the joint is assembled.

#### IV.2.D.10.4 SCREWED JOINTS

Screwed joint connections shall be made after all threaded surfaces have been thoroughly cleaned and prepared with approved sealing tape or pipe jointing compound.

#### IV.2.D.10.5 FLARED JOINTS

All copper joints will be deburred with a manufactured deburring tool prior to flaring.

#### IV.2.D.11 POLYETHYLENE ENCASEMENT

Polyethylene encasement will be installed per the manufacturer's recommendation except as modified herein. Tube-form polyethylene sections will be sealed at both ends with adhesive tape or plastic tie straps at the joint overlap. Circumferential wraps of tape should be placed at 2-foot intervals along the barrel of the pipe to minimize the space between the polyethylene and the pipe.

#### IV.2.D.12 ASSEMBLIES

All hydrants, valves, fittings, and appurtenances shall be installed as shown in the applicable Standard Detail at the locations indicated on the Plans or as otherwise directed by the Engineer.

##### IV.2.D.12.1 FIRE HYDRANTS

A solid precast concrete base pier block set on undisturbed earth shall be provided for each hydrant. The vertical barrel of each hydrant shall be well braced with a concrete reaction backing poured against unexcavated earth at the end of the trench and for hydrant installations less than one pipe length from the main, shall be tied to the pipe with mechanical joint restrained retainer glands. Retainer glands shall not be required for installations more than one pipe length from the main. Minimum pipe thickness where retainer glands are used shall be Class 52.

Drainage shall be provided for the hydrant by placing Class B Back fill from the bottom of the trench at the base of the hydrant to at least 6-inches above the inlet pipe. Similar material shall be placed in the inlet pipe trench for the full length from the hydrant to the main.

All hydrants shall stand plumb. When placed in the open area between the curb and sidewalk or directly behind the curb where no sidewalk is proposed, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 12-inches nor more than 18-inches from the gutter face of the curb unless otherwise specified. When set behind the sidewalk, no portion of the hydrant or nozzle cap shall be less than 6-inches nor more than 18-inches from the sidewalk unless otherwise specified. It shall be the Contractor's responsibility to assure that such horizontal clearances are satisfied regardless of approximate distances from the main as may be noted on the Plans. The Contractor shall make any necessary horizontal adjustment to improperly set hydrants at no additional cost to the City. Hydrants shall be set so that the center of the safety breakaway flange is located a minimum of 2-inches and a maximum of 8-inches above finished

sidewalk or ground level. Localized fill or mounding around the hydrant will not be allowed to achieve an acceptable vertical clearance of the breakaway flange.

Hydrants set too high shall be removed and replaced with an appropriate hydrant by the Contractor at his/her own expense. Extensions required for hydrants set too low shall be supplied and installed by the Contractor at his/her own expense. Following installation, the Contractor shall conceal each hydrant with a tarp, plastic sheet, or other suitable covering securely fastened until the hydrant is accepted for use.

#### IV.2.D.12.2 METER BOXES

Approved water meter boxes shall be provided at every water service assembly at the locations shown on the plans or as directed by the Engineer. Each meter box shall be set on 4-inch of compacted 3/4-inch minus crushed aggregate at an elevation that places the top of the meter box cover flush with the proposed grade as specified.

#### IV.2.D.12.3 VALVES AND VALVE BOXES

Valves shall be set and joined to the pipe in the manner previously specified for cleaning, laying, and jointing pipe. Valves shall be provided with a precast concrete pad for support so that the pipe will not be required to support the weight of the valve. Following installation, bolts and nuts for flanged and mechanical joint connections shall be coated with a bituminous seal coating and the valve shall be operated from the fully open to fully closed position to assure that the valve does not bind during operation. The area around valves shall be back filled in the same manner as specified for the adjoining pipe.

A valve box shall be provided for every valve. The valve box shall be centered along the axis of the operating nut of the valve and shall be set so as not to transmit shock or stress to the valve or valve operator. The exposed end of the valve box shall remain accessible at all times. The Contractor shall be responsible for keeping the valve box free of rocks and other debris for the duration of the project. Any misalignment or necessary readjustment of valve boxes shall be corrected by the Contractor at no additional cost to the City.

A valve operator extension shall be provided for every valve where the operating nut is in excess of 6-feet from finished grade. The extension shall be of such length that its operating nut in place is within 1- to 2-feet of finished grade. The cost of furnishing and installing valve operator extensions shall be considered incidental to and included in the cost of other bid items and no additional payment shall be made.

#### IV.2.D.12.4 FITTINGS

Fittings shall be set and joined to the pipe in the manner previously specified for cleaning, laying, and jointing pipe.

All plugs, caps, tees, and bends deflecting 1 1/4° or more on mains 4-inch in diameter or larger shall be securely anchored as indicated on the Plans and as shown in the Standard Detail by thrust blocking and/or joint restraint to prevent movement due to thrust.

#### IV.2.D.12.5 TAPPING THE MAIN

Tapping valves and sleeves shall be installed by the Contractor in accordance with the manufacture's requirements and as previously specified for installing valves and fittings.

Taps into existing mains or newly tested and accepted mains shall be performed exclusively by the City. Taps scheduled through public contract shall be performed at the City's expense. Taps scheduled for private development shall be performed at the developer's expense. The Contractor shall provide a minimum of 10 working days notice to the Engineer to schedule tap. Taps shall be made between 8:00 a.m. and 2:00 p.m., Monday through Friday, holidays excepted. Prior to making a tap the Contractor shall excavate a 4-foot wide trench 2-feet behind and 8-feet in front of the tapping valve with a trench floor at least 1-foot below the existing pipe elevation. The Contractor shall also provide and maintain shoring and dewatering during the tapping operation. Contractor will supply and install tapping sleeve and valve.

#### IV.2.D.12.6 LINE STOPS

Line stop tapping sleeves shall be installed by the Contractor in accordance with the manufacture's requirements.

Line stops shall be performed exclusively by the City. Line stops completed for a public contract shall be performed at the City's expense. Stops completed for private development shall be performed at the developer's expense. The Contractor shall provide a minimum of 10 working days notice to the Engineer to schedule the work which will be completed between 8:00 AM and 2:00 PM, Monday through Friday, holidays excepted. Prior to installing the stop, the Contractor shall excavate a 4-foot wide trench 2-feet behind and 8-feet in front of the tapping sleeve with a trench floor at least 1-foot below the existing pipe elevation. The Contractor shall also provide and maintain shoring and dewatering during the tapping operation.

Contractor will supply and install the line stop tapping sleeve. Prior to the City installing the stop, the Contractor will install a blind flange or plug supplied by the City on the sleeve. The outlet will then be pressurized to 70 psi. Upon stabilization, the sleeve will hold 70 psi for 1 minute.

#### IV.2.D.12.7 AIR VALVES

Piping and fittings for air valves shall be installed per Detail 305.

#### IV.2.D.12.8 DEAD-END MAINS AND BLOW-OFFS

All dead-ends on new mains shall be closed with a ductile iron MJ plug-and a minimum 2-inch blow-off assembly in conformance with the Standard Detail. The plugged or capped pipe length shall be at least 16-feet, preceded by a main line valve, and shall be securely anchored by installing a retainer gland along the pipe barrel and covering the retainer gland with a 6 mil plastic protective sheet and, finally, with a poured concrete straddle block. No direct contact between the pipe and concrete will be allowed. Minimum pipe thickness when retainer glands are used shall be Class 52. Piping from the plug or cap to the gate valve shall be red brass pipe with cast bronze fittings. Pipe and fittings beyond the valve shall be brass. The ductile iron gate valve shall

be set on a precast concrete block and shall be provided with a valve box and cover extending to within 12-inches of finished grade and conforming in all other respects to the materials and workmanship previously outlined for valve boxes. The blow-off pipe shall extend to within 4- to 6-inches of finished grade and shall be provided with a coupling and plug at its end. Access to the valve box and blow-off pipe shall be provided by a Christy Model B-36 meter box kept free of rocks and debris at all times and installed such that the lid is flush with finished grade. For installations in streets, driveways, or other areas subject to vehicular traffic, a solid cast iron meter box cover shall be supplied. For installations in sidewalks or other areas not subject to vehicular traffic, a concrete cover with a reading lid shall be supplied. The meter box may be set against the back of the curb; however, no other portion of the meter box shall be within 6-inches of the edge of any sidewalk or driveway apron.

#### IV.2.D.12.9 SERVICES

All water services shall be a minimum of 1-inch in size.

Service taps on existing City maintained water lines will be performed by the City at the Contractor's expense. The Contractor will provide all excavation and materials necessary to complete the tap and service installation.

Service taps on new lines not yet accepted by the City shall be performed by the Contractor. Tapping shall be performed with industry standard equipment manufactured solely for the purpose of water main tapping. Prior to performing any taps, the Contractor shall submit to the Engineer for approval, the equipment and procedure he/she intends to utilize for the water main taps. Service taps shall be located at 10:00 or 2:00 on the circumference of the pipe. Two or more service lines may be installed in the same trench when tapped with a minimum clear distance of 18-inches from any bell joint or between taps on a main line.

Water service assemblies shall be furnished and installed by the Contractor at the locations shown on the plans or as directed by the Engineer. The Contractor shall furnish all labor, equipment, materials, and tools necessary to install, complete and ready for operation, the assemblies as shown on the plans and herein specified. The Contractor shall perform the installation of the services in accordance with City Standard Detail No. 306, so that meters can be installed to the clearance and grades shown.

All service piping shall be of the size and material as shown on the plans and/or in the proposal unless otherwise specified. Identification of each service shall be accomplished by installing an appropriately sized meter box over the angle meter valve. Services installed in driveways or vehicular travelways shall be supplied with a cast iron lid.

All service lines from the water main to the meter shall be 30-inches below finish grade. The Contractor is responsible for establishing horizontal and vertical control of angle stops prior to meter installation.

#### IV.2.D.12.10 CONNECTIONS TO EXISTING VALVES

When connecting to an existing valve, the contractor will install a blind flange or plug supplied by the City on the valve. The valve will then be closed and pressurized to 70 psi.



Upon stabilization, the pressure will be monitored for 1 minute, and the results reported to the Engineer. In the event that a valve does not hold 70 psi for 1 minute, the City will have the option of repairing or replacing the valve prior to contractor connection.

#### IV.2.D.13 THRUST RESTRAINT

Concrete thrust blocking shall be poured in place unless precast blocks are authorized by the Engineer. Thrust blocking shall be placed between undisturbed earth and the fittings to be anchored in accordance with the Standard Detail. The area in which the blocking is to be placed shall be sufficiently excavated to receive the concrete so that the proper shape and bearing surface is attained. The bearing surface shall be sized and located by the Engineer and shall, unless otherwise directed, be so placed that the pipe and fitting joints will be accessible for repair. Concrete shall in no case extend around more than 1/2 the circumference of the fitting at any point. A plastic shield or other similar protection shall be placed between the concrete and any portions of the pipe, valve, fitting, bolts, or nuts with which it comes in contact to prevent dielectric corrosion damage.

Where specified or when approved by the Engineer, mechanical joint retainer glands shall be installed in accordance with the manufacturer's requirements and as shown in the Standard Detail. Calculations supporting the placement of restrained retainer glands will be provided to the Engineer prior to approval.

#### IV.2.D.14 DEVIATIONS FROM PLANS

Wherever obstructions not shown on the Plans are encountered during the progress of the work and interfere to such an extent that an alteration in the Plan is required, the Engineer shall have the authority to change the Plans and order a deviation from the line and grade or take other such action as necessary to avoid the conflict. If the change in Plans results in a change in the amount of work by the Contractor, such altered work shall be done on the basis of payment to the Contractor for extra work or credit to the City for less work.

#### IV.2.D.15 FILLING THE MAIN

Water mains shall be filled under the direction of the Engineer in such a manner as to prevent excessive pressure reductions in the existing main or excessive pressures in the new main. Valves used for filling the new main shall be operated by City personnel only and positive flow maintained at all times.

#### IV.2.D.16 FLUSHING

Prior to chlorination, the main shall receive a complete flushing through all hydrants and blow-offs such that a velocity of at least 2.5-feet per second is developed in the main. This flushing shall be accomplished during prearranged times under direction and supervision of the Engineer. If sufficient outlets are not available, a tap shall be provided large enough to develop the required velocity in the main. (see Table II below)

All valves shall be operated through their extreme open and closed positions during flushing. Each hydrant shall be inspected after flushing to see that the entire valve operating mechanism is in good condition.

Flushing water onto the street subgrade shall not be allowed at any time. Provisions for the disposal of the water onto areas where no damage will be caused shall be made by the Contractor prior to any flushing operations.

TABLE II REQUIRED OPENINGS FOR 2.5 fps FLUSHING VELOCITY (40 psi PRESSURE)				
PIPE SIZE (inch)	FLOW (gpm)	ORIFICE SIZE (inch)	HYDRANT OUTLET NOZZLES	
			NUMBER	DIAMETER (inch)
4	100	1-5/16	1	2 ½
6	220	1-3/8	1	2 ½
8	390	1-7/8	1	2 ½
10	610	2-5/16	1	2 ½
12	880	2-13/16	1	2 ½
14	1200	3-1/4	2	2 ½
16	1565	3-5/8	2	2 ½
18	1980	4-3/16	2	2 ½
20	2450	4-5/8	3	2 ½
24	3510	5-9/16	4	2 ½
			1	4 ½
			or	
			5	2 ½
30	5500	7	5	2 ½
			1	4 ½
			or	
			2	2 ½
			2	4 ½

#### IV.2.D.17 DISINFECTION

Prior to being placed in service, all new mains, repaired portions of existing mains, or extensions to existing mains, shall be disinfected by chlorination in conformance with AWWA C651 except as modified herein.

Disinfection of water mains will take place subsequent to successful completion of pressure and leakage testing. All lines to be disinfected will be backfilled prior to chlorination.

Chlorination will be accomplished by the continuous feed method (AWWA C651, Sec. 5.2). The tablet and slug methods may be used with prior approval by the City. If powdered or granular chlorine is used it must be fully dissolved, no chlorine granuals shall be allowed to enter the new main.

Chlorinated water will be discharged according to best management practices as established by the State of Oregon, Department of Environmental Quality. Prior to discharge, the Contractor will submit a discharge plan for approval by the Engineer.

Chlorination shall be performed in such a manner so as to prevent heavily chlorinated water from backflowing into the City's potable water systems. Valves separating the City's potable water system from pipe not yet accepted by the City will be operated by City personnel only. In no case will such valves be opened without providing a means of sufficient discharge from lines not yet accepted by the City.

The City shall conduct all sampling and testing procedures required for testing bacteriological quality and turbidity. The Contractor shall provide sampling points at intervals of approximately 200-feet and as approved by the Engineer. Samples will be taken only on Monday through Thursday between 8:30 a.m. and 1:00 p.m. No samples will be taken on days prior to holidays. The Contractor shall provide 24 hours minimum notice to the Engineer for samples to be taken. Sample results must meet Oregon State Health Division standards for potable water systems prior to acceptance by the City.

Should the initial treatment fail to result in an acceptable water quality, disinfection shall be repeated at the Contractor's expense until satisfactory results are achieved. No extra payment or extension of contract time will be allowed the Contractor for the time elapsed to achieve acceptable disinfection of the pipe.

#### IV.2.D.18 VALVE OPERATION

Only City personnel shall operate existing valves, or newly tested and accepted valves.

#### IV.2.E.00 TESTING

##### IV.2.E.01 HYDROSTATIC TESTING

##### IV.2.E.01.1 PRESSURE TESTING

Hydrostatic pressure tests shall be made on all valved sections of all newly laid main and service pipe thereof unless otherwise directed by the Engineer. Pressure tests shall be conducted prior to disinfection of the line but after all curbs have been placed and angle stop locations verified. All entrained air shall be expelled from the line prior to elevating the internal pressure to the specified test pressure. The test pressure shall be 150 psi calculated for the point of highest elevation but shall not exceed 200 psi at any point. The test pressure shall be applied and

maintained for a 2 hour duration unless otherwise specified by the Engineer. Thrust blocking required for any reach of pipe shall be allowed a minimum of 3 days cure time prior to pressure testing.

#### IV.2.E.01.2 LEAKAGE TESTING

A leakage test shall be conducted concurrently with the pressure test. The City shall furnish the pressure gauge and monitor the test and the Contractor shall furnish the pump, pipe, connections, and all other necessary apparatus and shall conduct the test. Testing shall be against closed hydrants with pipe line valves open. In addition, the test shall include the service lines to the closed meter stops with corporation stops open.

The test shall be in conformance with AWWA C600 Section 4 and observed by the Engineer. However the minimum test pressure shall be 150 psi at the highest elevation of the section being tested as determined by the Engineer but shall be reduced by the Engineer to avoid test pressures exceeding 200 psi at the lowest elevation of the section being tested.

#### IV.2.E.02 BACTERIOLOGICAL TESTING

Following chlorination, all treated water shall be thoroughly flushed from the pipeline at its extremities including each individual service until the replacement water throughout its length shall, upon testing, contain 1 ppm free chlorine residual or less. This satisfactory chlorine residual level shall be found upon testing in the main 24 hours after final flushing. Unless otherwise approved, all samples will be collected by the City and analyzed in the City's lab.

Should the initial treatment fail to result in the specified conditions, the original chlorination procedure or another method approved by the City shall be repeated at the Contractor's expense until satisfactory results are obtained. No extra payment or extension of Contract time will be allowed the Contractor for the time elapsed to achieve acceptable disinfection of the pipe.

### IV.2.F.00 MEASUREMENT AND PAYMENT

#### IV.2.F.01 PIPE INSTALLATION

Payment for installation of waterline pipe shall be made at the unit Contract price per linear foot for the various types and sizes of pipe listed in the Proposal as actually installed. The measure for payment will be the field measured centerline length of the pipe in place within the limits shown on the Plans. Payment for pipe installation shall constitute full compensation for all labor; equipment; clearing the construction area; trench excavation, bedding, and back-fill operations (except rock excavation); fittings, couplings, and spools; anchorage and thrust restraint; flushings; disinfection; and any incidental expenses necessary to prepare the constructed waterline for use and connection to the existing water distribution system.

#### IV.2.F.02 VALVES AND ASSEMBLIES

Valves and assemblies (including blow-off assemblies) shall be paid for at the unit Contract price shown in the Proposal for each type of installation, approved and in place. Payment for each valve and assembly shall constitute full compensation for furnishing and installing the valve or assembly complete, including valve pad, valve box, connection pipe between fittings, and any

other incidental expenses necessary to complete the installation. Unless otherwise specified, mechanical couplings and joint restraint will be considered incidental to and included in the unit price bid for pipe or fittings whether joint restraint is accomplished by means of anchor blocks or retainer glands.

Payment for fire hydrant assemblies shall be made at the unit Contract price bid, approved and in place. Payment for each hydrant assembly shall constitute full compensation for all costs of labor, equipment, and any incidental expenses required for each installation including excavation and back fill. The cost of furnishing and installing drain gravel, base blocks, 6-inch pipe, fittings, valves, and thrust blocks shall be considered incidental to and included in the unit price of the hydrant assembly installation.

#### IV.2.F.03 SERVICES

Payment for installation of services shall be made at the unit contract price per lineal foot for the various types and sizes of services listed in the proposal as actually installed. All pipe will be measured horizontally from the center of the main to the angle meter valve within the limits as shown on the plans or as directed by the Engineer. Payment for each service installation shall constitute full compensation for all labor, equipment, and materials required for tapping, trench excavation, bedding and back fill, pipe installation, flushing, disinfection, and any incidental expenses necessary for all the contract work as specified or covered by this section.

All fittings and connections, either shop fabricated or field fabricated, the angle meter valve, and meter box shall be considered incidental to the pipe laying and no separate payment will be made for them unless otherwise specified.

#### IV.2.F.04 INCIDENTALS

The cost of incidental items, including, but not limited to concrete, tie rods, and retainer glands for thrust restraint; extra bolts and nuts as may be necessary for jointing operations; special equipment required for any installation; or any other costs incurred on the project not listed in the proposal as pay items shall, unless otherwise specified, be considered as incidental to the construction and included in other bid items and no extra payment will be made.